

## **Virginia Stormwater Management Model Ordinance**

This model ordinance is intended to be a tool to assist communities in creating their own stormwater management ordinance to be consistent with the Virginia Stormwater Management Law (§10.1-603.1 et seq.) and Regulations (4VAC3-20). The Virginia Stormwater Management Law contains specific minimum requirements for local stormwater programs:

1. Maintain after-development runoff rate of flow, as nearly as practicable, as the pre-development runoff characteristics;
2. Establish minimum design criteria for measures to control nonpoint source pollution, localized flooding, and stream channel erosion;
3. Provisions for long-term responsibility for and maintenance of stormwater management measures intended to manage the quality and quantity of runoff; and
4. Provisions for the integration of locally adopted stormwater management programs with other local programs (such as erosion and sediment control, flood plain management, etc.) requiring compliance in order to better coordinate and streamline the administrative processes of plan submission and approval, issuance of permits, payment of fees, and coordination of inspection and enforcement activities.

This ordinance has been developed to meet these minimum requirements. Basic minimum technical criterion are provided, however, this model, as well as local ordinances developed with this model as guidance, should utilize a technical support document, such as the Virginia Stormwater Management Handbook, for specific design purposes. This will allow the criteria to be periodically modified in order to reflect current engineering methods (as required in §10.1-603.4.2 Code of Virginia).

In designing a model stormwater ordinance for implementation at the local level, we purposely avoided creating too complex an ordinance, and instead have included suggestions for *optional* language and concepts that we believe a good stormwater management ordinance should contain. This ordinance is representative of a good base that communities can customize and build upon to correspond with local staff resources, relative development pressure, and watershed resources. We recommend that you use and modify this document as appropriate to comply with other existing ordinances in your locality. The Virginia Stormwater Management Handbook identified throughout this document refers to the latest edition listed on the DCR website. Updates and revisions will be identified in an errata sheet.

In order to customize this ordinance, there are sections where the name of the local stormwater authority that has regulatory power over stormwater management must be inserted. These sections are denoted by text placed in brackets—( ). By using this ordinance and customizing these sections, one can create a viable local ordinance with minimal editing.

Italicized text with this symbol *5* should be interpreted as comments, instructions, or information to assist the ordinance writer. This text **should not appear** in your final ordinance.

## **Model Ordinance for the Control of Post Construction Stormwater Runoff**

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### **Introduction**

*5 This section is reserved for local governments to establish the environmental, economic, and social justification or “Findings of Fact” for the adoption of a stormwater management ordinance. The Virginia Stormwater Management Law starts with a “finding” that the “. . . the lands and waters of the Commonwealth are great natural resources; that as a result of intensive land development and other land use conversions, degradation of these resources frequently occurs in the form of water pollution, stream channel erosion, depletion of groundwater resources, and more frequent localized flooding; that these impacts adversely affect fish, aquatic life, recreation, shipping, property values and other uses of lands and waters; and that existing authorities under the Code of Virginia do not adequately address all of these impacts. Therefore the General Assembly finds it in the public interest to enable the establishment of stormwater management programs.” (§10.1-603.1)*

*Local governments are encouraged to introduce their ordinance with findings specific to the impacts on aquatic resources and properties within their jurisdiction.*

### **Section 1. General Provisions**

#### **1.1. Statutory Authority**

The Virginia Stormwater Management Law (“Law”), Title 10.1, Chapter 6, Article 1.1 of the Code of Virginia, enables localities to adopt , by ordinance, a stormwater management program consistent with state regulations promulgated pursuant to the Law.

*5 Localities may consider including other enabling authority, especially when including alternative funding programs to support the implementation of the local program, such as*

*Stormwater Utilities, Title 15.2, Chapter 21, Article 2, Section 2114; Payment by Sub-divider of the Pro Rata Share of the Cost of Certain Facilities. § 15.2-2243 of the Code of Virginia*

## **1.2. Purpose**

The purpose of this ordinance is to establish minimum stormwater management requirements and controls to protect properties, safeguard the general health, safety, and welfare of the public residing in watersheds within this jurisdiction, and protect aquatic resources. This ordinance seeks to meet that purpose through the following objectives:

1. Require that land development and land conversion activities Maintain the after-development runoff characteristics, as nearly as practicable, as the pre-development runoff characteristics in order to reduce flooding, siltation, stream bank erosion, and property damage;
2. Establish minimum design criteria for the protection of properties and aquatic resources downstream from land development and land conversion activities from damages due to increases in volume, velocity, frequency, duration, and peak flow rate of storm water runoff;
3. Establish minimum design criteria for measures to minimize nonpoint source pollution from stormwater runoff which would otherwise degrade water quality;
4. Establish provisions for the of long-term responsibility for and maintenance of stormwater management control devices and other techniques specified to manage the quality and quantity of runoff; and
5. Establish certain administrative procedures for the submission, review, approval, and disapproval of stormwater plans, and the inspection of approved projects.

*5 Localities are authorized to adopt more stringent stormwater management regulations than those necessary to ensure compliance with the Board's minimum regulations, with the exception of regulations related to plan approval, provided that the more stringent regulations are based upon the findings of local comprehensive watershed management studies and that prior to adopting more stringent regulations a public hearing is held after giving due notice. The above list are, in part, the State of Virginia minimum objectives (§10.1-603.4) for regulations to reduce the impact of stormwater on receiving waters. The local stormwater authority may wish to set more stringent objectives, based on priority water quality and habitat problems (e.g., to reduce phosphorus loads being delivered to recreational lakes or water supply reservoirs, to sustain a trout fishery, etc.)*

### 1.3. Applicability

This ordinance shall be applicable to all subdivision, site plan, or land use conversion applications, unless eligible for an exception by the \_\_\_\_\_ (jurisdictional stormwater authority) under the specifications of Section 4 of this ordinance. The ordinance also applies to land development activities that are smaller than the minimum applicability criteria if such activities are part of a larger common plan of development that meets the applicability criteria, even though multiple separate and distinct land development activities may take place at different times on different schedules. In addition, all plans must also be reviewed by local environmental protection officials to ensure that established water quality standards will be maintained during and after development of the site and that post construction runoff levels are consistent with any local and regional watershed plans.

To prevent the adverse impacts of stormwater runoff, the \_\_\_\_\_ (jurisdictional stormwater authority) has developed a set of performance standards that must be met at new development sites. These standards apply to any land development or land use conversion activity disturbing one (1) acre or more of land.

*5 The jurisdiction may adopt a smaller area threshold for their stormwater management ordinance. Smaller areas are under regulatory authority under other existing programs. The menu of water quality BMP option has several practices that can easily manage and treat smaller sites (less than one (1) acre). The Chesapeake Bay Preservation Act Regulations require water quality assessments on projects as small as 2,500 square feet, and the Virginia Erosion and Sediment Control regulations require a stream channel erosion assessment (MS-19-4VAC50-30-40.19) on sites as small as 10,000 square feet. It is therefore suggested to apply water quality BMP's on all storm drain outfalls and proposed impervious areas.*

The following activities are exempt from these stormwater performance criteria:

1. Permitted surface or deep mining operations and projects, or oil and gas operations and projects conducted under the provisions of Title 45.1 of the Act;
2. Tilling, planting or harvesting of agricultural, horticultural, or forest crops;
3. Single-family residences separately built and not part of a subdivision, including additions or modifications to existing single-family detached residential structures;
4. Land development projects that disturb less than one acre of land area; however, the governing body of a locality which has adopted a stormwater management program may reduce this exception to a smaller area of disturbed land or qualify the conditions under which this exception shall apply; and

5. Linear development projects, provided that (i) less than one acre of land will be disturbed per outfall or watershed, (ii) there will be insignificant increases in peak flow rates, and (iii) there are no existing or anticipated flooding or erosion problems downstream of the discharge point.

When a site development plan is submitted that qualifies as a redevelopment project as defined in Section 2 of this ordinance, decisions on permitting and on-site stormwater requirements shall be governed by the stormwater sizing criteria found in the current Virginia Stormwater Management Handbook. This criteria is dependent on the amount of impervious area created by the redevelopment and its impact on water quality. Final authorization of all redevelopment projects will be determined after a review by the \_\_\_\_\_(jurisdictional stormwater authority).

#### **1.4. Compatibility with Other Permit and Ordinance Requirements**

This ordinance is not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute, or other provision of law. The requirements of this ordinance should be considered minimum requirements, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall be considered to take precedence.

#### **1.5. Severability**

If the provisions of any article, section, subsection, paragraph, subdivision or clause of this ordinance shall be judged invalid by a court of competent jurisdiction, such order of judgment shall not affect or invalidate the remainder of any article, section, subsection, paragraph, subdivision or clause of this ordinance.

#### **1.6. Stormwater Management Handbook**

The \_\_\_\_\_(jurisdictional stormwater authority) will utilize the policy, criteria and information including specifications and standards of the Virginia Stormwater Management Handbook (or local equivalent), for the proper implementation of the requirements of this ordinance. This Handbook includes a list of acceptable stormwater treatment practices, including the specific design criteria for each stormwater practice. The Handbook may be updated and expanded from time to time, based on improvements in engineering, science, monitoring and local maintenance experience. Stormwater treatment practices that are designed and constructed in accordance with these design and sizing criteria will be presumed to meet the minimum water quality performance standards.

*5 All references to the Virginia Stormwater Management Handbook (or local equivalent), are presumed to be the "latest edition" as defined on the Virginia Department of Conservation and Recreation website. Updates and revisions will be made periodically and itemized on the DCR Website. The jurisdictional stormwater authority and local ordinance should make reference to minimum design standards as specified in the referenced stormwater Handbook. Local authorities may desire to develop a local handbook that complements or replaces the Virginia*

*Stormwater Management Handbook provided that this reference is at least as stringent as the Virginia Stormwater Management Handbook.*

## Section 2. Definitions:

**“Accelerated Erosion”** means erosion caused by development activities that exceeds the natural processes by which the surface of the land is worn away by the action of water, wind, or chemical action.

**"Act"** means Article 1.1 (§ 10.1-603.1 et seq.) of Chapter 6 of Title 10.1 of the Code of Virginia.

**“Adequate Channel”** means a channel with a defined bed and banks, or an otherwise limited flow area that will convey the designated frequency storm event without overtopping the channel banks nor causing erosive damage to the channel bed or banks.

**“Applicant”** means any person submitting a stormwater management plan for approval.

**“Aquatic Bench”** means a 10- to 15- foot wide bench around the perimeter of a permanent pool that ranges in depth from zero to 12 inches. Vegetated with emergent plants, the bench augments pollutant removal, provides habitats, conceals trash and water level fluctuations, and enhances safety.

**“Average Land Cover Condition”** means a measure of the average amount of impervious surfaces within a watershed, assumed to be 16 %. Note that a locality may opt to calculate actual watershed-specific values for the average land cover condition based upon 4VAC 3-20-101.

**“Best Management Practice (BMP)”** means a structural or nonstructural practice which is designed to minimize the impacts of development on surface and groundwater systems.

**“Bioretention Basin”** means a water quality BMP engineered to filter the water quality volume through an engineered planting bed, consisting of a vegetated surface layer (vegetation, mulch, ground cover), planting soil, and sand bed, and into the in-situ material.

**“Bioretention Filter”** means a bioretention basin with the addition of a sand filter collection pipe system beneath the planting bed.

**“Board”** means the Virginia Board of Conservation and Recreation

**“Building”** means any structure, either temporary or permanent, having walls and a roof, designed for the shelter of any person, animal, or property, and occupying more than 100 square feet of area.

**“Channel”** means a natural or artificial watercourse with a definite bed and banks that conducts continuously or periodically flowing water.

**“Constructed Wetlands”** means areas intentionally designed and created to emulate the water quality improvement function of wetlands for the primary purpose of removing pollutants from stormwater.

**“Dedication”** means the deliberate appropriation of property by its owner for general public use.

**"Department"** means the Virginia Department of Conservation and Recreation.

**“Detention”** means the temporary storage of storm runoff in a stormwater management practice with the goals of controlling peak discharge rates and providing gravity settling of pollutants.

**“Detention Facility”** means a detention basin or alternative structure designed for the purpose of temporary storage of stream flow or surface runoff and gradual release of stored water at controlled

rates.

**“Developer”** means a person who undertakes land disturbance activities.

**“Development”** means *land development* or *land development project*.

**“Drainage Easement”** means a legal right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.

**“Erosion and Sediment Control Plan”** means a plan that is designed to minimize the accelerated erosion and sediment runoff at a site during construction activities.

**“Fee in Lieu”** means a payment of money in place of meeting all or part of the storm water performance standards required by this ordinance.

**“Flooding”** means a volume of water that is too great to be confined within the banks or walls of the stream, water body or conveyance system and that overflows onto adjacent lands, causing or threatening damage.

**“Grassed Swale”** means an earthen conveyance system which is broad and shallow with erosion resistant grasses and check dams, engineered to remove pollutants from stormwater runoff by filtration through grass and infiltration into the soil.

**“Hotspot”** means an area where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

**“Hydrologic Soil Group (HSG)”** means a Natural Resource Conservation Service classification system in which soils are categorized into four runoff potential groups. The groups range from A soils, with high permeability and little runoff production, to D soils, which have low permeability rates and produce much more runoff.

**“Impervious Cover”** means a surface composed of any material that significantly impedes or prevents natural infiltration of water into soil. Impervious surfaces include, but are not limited to, roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface.

**“Industrial Stormwater Permit”** means an National Pollutant Discharge Elimination System permit issued to a commercial industry or group of industries which regulates the pollutant levels associated with industrial stormwater discharges or specifies on-site pollution control strategies.

**“Infiltration”** means the process of percolating stormwater into the subsoil.

**“Infiltration Facility”** means any structure or device designed to infiltrate retained water to the subsurface. These facilities may be above grade or below grade.

**“Jurisdictional Wetland”** means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

**“Land Development”** or **“Land Development Project”** means a manmade change to the land surface that potentially changes its runoff characteristics.

**“Land Disturbance Activity”** means any activity which changes the volume or peak flow discharge rate of rainfall runoff from the land surface. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, substantial removal of vegetation, or any activity which bares soil or rock or involves the diversion or piping of any natural or man-made watercourse.

**“Landowner”** means the legal or beneficial owner of land, including those holding the right to purchase or lease the land, or any other person holding proprietary rights in the land.

**“Linear Development Project”** means a land development project that is linear in nature such as, but not limited to, (i) the construction of electric and telephone utility lines, and natural gas pipelines; (ii) construction of tracks, rights-of-way, bridges, communication facilities and other related structures of a railroad company; and (iii) highway construction projects.

**“Local Stormwater Management Program”** or **“Local Program”** means a statement of the various methods adopted pursuant to the Act and implemented by a locality to manage the runoff from land development projects and shall include an ordinance with provisions to require the control of after-development stormwater runoff rate of flow, water quality, the proper maintenance of stormwater management facilities, and minimum administrative procedures consistent with this chapter.

**“Locality”** means a county, city, or town.

**“Maintenance Agreement”** means a legally recorded document that acts as a property deed restriction, and which provides for long-term maintenance of storm water management practices.

**“Nonpoint Source (NPS) Pollution”** means pollution from any source other than from any discernible, confined, and discrete conveyances, and shall include, but not be limited to, pollutants from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.

**“Nonpoint Source Pollutant Runoff Load”** or **“Pollutant Discharge”** means the average amount of a particular pollutant measured in pounds per year, delivered in a diffuse manner by stormwater runoff

**“Offset Fee”** means a monetary compensation paid to a local government for failure to meet pollutant load reduction targets.

**“Off-Site Facility”** means a stormwater management measure located outside the subject property boundary described in the permit application for land development activity.

**“On-Site Facility”** means a stormwater management measure located within the subject property boundary described in the permit application for land development activity.

**“Owner”** means the owner or owners of the freehold of the premises or lesser estate therein, a mortgagee or vendee in possession, assignee of rents, receiver, executor, trustee, lessee or other person, firm or corporation in control of a property.

**“Percent Impervious”** means the impervious area within the site divided by the area of the site multiplied by 100.

**“Person”** means any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town or other political subdivision of the Commonwealth, any interstate body or any other legal entity.

**“Plan-approving Authority”** means the Board, the program authority, or a department of a program authority, responsible for determining the adequacy of a submitted stormwater management plan.

**“Planning Area”** means a designated portion of the parcel on which the land development project is located. Planning areas shall be established by delineation on a master plan. Once established, planning areas shall be applied consistently for all future projects.



**“Post-development”** refers to conditions that reasonably may be expected or anticipated to exist after completion of the land development activity on a specific site or tract of land.

**“Pre-development”** refers to the conditions that exist at the time that plans for the land development of a tract of land are approved by the plan approving authority. Where phased development or plan approval occurs (preliminary grading, roads and utilities, etc.), the existing conditions at the time *prior to* the first item being approved or permitted shall establish pre-development conditions.

**“Program Authority”** means a district, county, city or town which has adopted a stormwater management program which has been approved by the Board.

**“Recharge”** means the replenishment of underground water reserves.

**“Redevelopment”** means the process of developing land that is or has been previously developed.

**“Regional (watershed-wide) Stormwater Management Facility”** or **“Regional Facility”** means a facility or series of facilities designed to control stormwater runoff from a specific watershed, although only portions of the watershed may experience development.

**“Regional (watershed-wide) Stormwater Management Plan”** or **“Regional Plan”** means a document containing material describing how runoff from open space, existing development and future planned development areas within a watershed will be controlled by coordinated design and implementation of regional stormwater management facilities.

**“Runoff”** or **“stormwater runoff”** means that portion of precipitation that is discharged across the land surface or through conveyances to one or more waterways.

**“Sand Filter”** means a contained bed of sand which acts to filter the first flush of runoff. The runoff is then collected beneath the sand bed and conveyed to an adequate discharge point or infiltrated into the in-situ soils.

**“Shallow Marsh”** means a zone within a stormwater extended detention facility that exists from the surface of the normal pool to a depth of six to 18 inches, and has a large surface area and, therefore requires a reliable source of baseflow, groundwater supply, or a sizeable drainage area to maintain the desired water surface elevations to support emergent vegetation

**“Site”** means the parcel of land being developed, or a designated planning area in which the land development project is located

**“State Waters”** means all waters on the surface and under the ground wholly or partially within or bordering the Commonwealth or within its jurisdiction.

**“Stop Work Order”** means an order issued which requires that all construction activity on a site be stopped.

**“Stormwater Detention Basin”** or **“Detention Basin”** means a stormwater management facility which temporarily impounds runoff and discharges it through a hydraulic outlet structure to a downstream conveyance system. While a certain amount of outflow may also occur via infiltration through the surrounding soil, such amounts are negligible when compared to the outlet structure discharge rates and are, therefore, not considered in the facility’s design. Since a detention facility impounds runoff only temporarily, it is normally dry during nonrainfall periods.

**“Stormwater Extended Detention Basin”** or **“Extended Detention Basin”** means a stormwater management facility which temporarily impounds runoff and discharges it through a hydraulic structure

over a period of time to a downstream conveyance system for the purpose of water quality enhancement or stream channel erosion control. While a certain amount of outflow may also occur via infiltration through the surrounding soil, such amounts are negligible when compared to the outlet structure discharge rates and, therefore, are not considered in the facility's design. Since an extended detention basin impounds runoff only, temporarily, it is normally dry during nonrainfall periods.

**“Stormwater Extended Detention Basin-Enhanced”** or **“Extended Detention Basin-Enhanced”** means an extended detention basin modified to increase pollutant removal by providing a shallow marsh in the lower stage of the basin.

**“Stormwater Management Facility”** means a device that controls stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow.

**“Stormwater Management”** means the use of structural or non-structural practices that are designed to reduce storm water runoff pollutant loads, discharge volumes, and/or peak flow discharge rates.

**“Stormwater Management Plan”** or **“Plan”** means a document containing material for describing how existing runoff characteristics will be affected by a land development project and methods for complying with the requirements of the local program.

**“Stormwater Retention Basin I”** or **“Retention Basin I”** means a retention basin with the volume of the permanent pool equal to three times the water quality volume.

**“Stormwater Retention Basin II”** or **“Retention Basin II”** means a retention basin with the volume of the permanent pool equal to four times the water quality volume.

**“Stormwater Retention Basin III”** or **“Retention Basin III”** means a retention basin with the volume of the permanent pool equal to four times the water quality volume with the addition of an aquatic bench.

**“Stormwater Retrofit”** means a stormwater management practice designed for an existing development site that previously had either no stormwater management practice in place or a practice inadequate to meet the stormwater management requirements of the site.

**“Stormwater Runoff”** means flow on the surface of the ground, resulting from precipitation.

**“Stormwater Treatment Practices (STPs)”** means measures, either structural or nonstructural, that are determined to be the most effective, practical means of preventing or reducing point source or nonpoint source pollution inputs to stormwater runoff and water bodies.

**“Stormwater Management plan”** or **“Plan”** means a document containing material for describing how existing runoff characteristics will be affected by a land development project and methods for complying with the requirements of the local program or this chapter.

**“Subdivision”** unless otherwise defined in a local ordinance adopted pursuant to § 15.1-465 of the Code of Virginia, means the division of a parcel of land into three or more lots or parcels of less than five acres each for the purpose of transfer of ownership or building development, or, if a new street is involved in such division, any division of a parcel of land. The term includes resubdivision and, when appropriate to the context, shall relate to the process of subdividing or to the land subdivided.

**“Town”** means an incorporated town.

**“Vegetated Filter Strip”** means a densely vegetated section of land engineered to accept runoff as

overland sheet flow from upstream development. It shall adopt any vegetated form, from grassy meadow to small forest. The vegetative cover facilitates pollutant removal through filtration, sediment deposition, infiltration and absorption, and is dedicated for that purpose.

“**Water Quality Volume (WQV)**” means the volume equal to the first ½ inch of runoff multiplied by the impervious surface of the land development project.

“**Watercourse**” means a permanent or intermittent stream or other body of water, either natural or man-made, which gathers or carries surface water.

“**Watershed**” means a defined land area drained by a river, stream, drainage ways or system of connecting rivers, streams, or drainage ways such that all surface water within the area flows through a single outlet.

### **Section 3. Stormwater Management Program Permit Procedures and Requirements**

#### **3.1. Permit Required.**

No land owner or land operator shall receive any of the building, grading or other land development permits required for land disturbance activities without first meeting the requirements of this ordinance prior to commencing the proposed activity.

Should a land-disturbing activity associated with an approved plan in accordance with this section not begin during the 180-day period following approval or cease for more than 180 days, \_\_\_\_\_ (jurisdictional stormwater authority, plan-approving authority, or the permit-issuing authority) may evaluate the existing approved erosion and sediment control plan and stormwater management plan to determine whether the plan still satisfies local program requirements and to verify that all design factors are still valid. If the authority finds the previously filed plan to be inadequate, a modified plan shall be submitted and approved prior to the resumption of land-disturbing activities.

*5 Local officials will need to decide the appropriate time frame for the duration of stormwater management permits. Again, this will often be determined by the staff available for permit review and inspection of sites undergoing construction.*

#### **3.2. Permit Application Requirements**

Unless specifically excluded by this ordinance, any land owner or operator desiring a permit for a land disturbance activity shall submit to the \_\_\_\_\_ (jurisdictional stormwater authority) a permit application on a form provided by the \_\_\_\_\_ (jurisdictional stormwater authority) for that purpose.

Unless otherwise excepted by this ordinance, a permit application must be accompanied by the following in order that the permit application be considered:

1. Stormwater management plan in accordance with Section 3.3;
2. Maintenance agreement in accordance with Section 3.4;
3. Performance bond in accordance with Section 3.5; and
4. Permit application and Plan review fee in accordance with Section 3.6.

5 *In general, existing plan submittal and review procedures and time frames within any given locality are acceptable as long as they meet the minimum administrative requirements of §10.1 - 603.8, 603.9, 603.10, 603.11 of the Law and 4VAC 3-20-111 & 4VAC 3-20-121 of the regulations.*

### **3.3. Stormwater Management Plan Required.**

No application for land development, land use conversion, or land disturbance will be approved unless it includes a stormwater management plan, as required by this ordinance, detailing how runoff and associated water quality impacts resulting from the activity will be controlled or managed.

A stormwater management plan shall consist of a *concept plan* to ensure adequate planning for the management of stormwater runoff, and a *final plan*. Both plans shall be in accordance with the criteria established in this section.

No building, grading, or sediment control permit shall be issued until a satisfactory final stormwater management plan, or a waiver thereof, shall have undergone a review and been approved by the \_\_\_\_\_ (jurisdictional stormwater authority) after determining that the plan or waiver is consistent with the requirements of this Ordinance.

5 *One way to handle the submittal requirements for both the concept plan and the final design plan is to utilize Submittal Checklists for submission of any plan. The benefit of this is that changes in submittal requirements can be made as needed without needing to revisit and alter the original ordinance. Appendix C includes three model checklists, in addition to those found in the Virginia SWM Handbook, that local communities may wish to review for ideas on requirements in their own submittal checklist.*

#### **1. Stormwater Management Concept Plan**

A stormwater management concept plan or proof of prior approval of a concept plan shall be required with all permit applications and will include all information from the submittal checklist to evaluate the environmental characteristics of the project site, the potential impacts of all proposed development of the site, both present and future, on the water resources, and the effectiveness and acceptability of the measures proposed for managing stormwater generated at the project site.

The concept plan should be prepared at the time of the preliminary plan of subdivision or other early step in the development process to identify the type of stormwater management measures necessary for the proposed project. The intent of this conceptual planning process is to ensure adequate planning for management of stormwater runoff from future development. To accomplish this goal the following information shall be included in the concept plan:

- A. A map (or maps) indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural stormwater management and sediment control facilities. The map(s) will also clearly show proposed land use with tabulation of the percentage of surface area to be adapted to various uses; drainage patterns; locations of utilities, roads and easements; the limits of clearing and grading; A written description of the site plan and justification of proposed changes in natural conditions may also be required.
- B. Sufficient engineering analysis to show that the proposed stormwater management measures are capable of controlling runoff from the site in compliance with this ordinance and the specifications of the Virginia Stormwater Management Manual.
- C. A written or graphic inventory of the natural resources at the site and surrounding area as it exists prior to the commencement of the project and a description of the watershed and its relation to the project site. This description should include a discussion of soil conditions, forest cover, topography, wetlands, and other native vegetative areas on the site. Particular attention should be paid to environmentally sensitive features that provide particular opportunities or constraints for development.
- D. A written description of the required maintenance burden for any proposed stormwater management facility.
- E. The \_\_\_\_\_ (jurisdictional stormwater authority) may also require a concept plan to consider the maximum development potential of a site under existing zoning, regardless of whether the applicant presently intends to develop the site to its maximum potential.
- F. The applicant may be required to include within the stormwater concept plan measures for controlling existing stormwater runoff discharges from development or redevelopment occurring on a previously developed site in accordance with the standards of this Ordinance to the maximum extent practicable.

*5 If the locality has identified any alternate or more stringent requirements for any given subwatershed, the concept plan can be used to ensure compliance prior to the final plan.*

## 2. Stormwater Management Final Plan

After review of the stormwater management concept plan, and modifications to that plan as deemed necessary by the \_\_\_\_\_ (jurisdictional stormwater authority), a final stormwater management plan must be submitted for approval.

All stormwater management plans shall be appropriately sealed and signed by a professional in adherence to all minimum standards and requirements pertaining to the practice of that profession in accordance with Chapter 4 (§ 54.1-400 et seq.) of Title 54.1 of the Code of Virginia and attendant regulations certifying that the plan meets all submittal requirements outlined in this ordinance and is consistent with good engineering practice.

The final stormwater management plan, in addition to the information from the concept plan, shall include all of the information required in the Final Stormwater Management Plan checklist found in the Virginia Stormwater Management Manual (or local equivalent). This includes:

### A. Contact Information

The name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected.

### B. Topographic Base Map

A 1" = 200' topographic base map of the site which extends a minimum of \_\_\_\_ feet beyond the limits of the proposed development and indicates existing surface water drainage including streams, ponds, culverts, ditches, and wetlands; current land use including all existing structures; locations of utilities, roads, and easements; and significant natural and manmade features not otherwise shown.

### C. Calculations

Hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in this ordinance. Such calculations shall include (i) description of the design storm frequency, intensity and duration, (ii) time of concentration, (iii) Soil Curve Numbers or runoff coefficients, (iv) peak runoff rates and total runoff volumes for each watershed area, (v) infiltration rates, where applicable, (vi) culvert capacities, (vii) flow velocities, (viii) data on the increase in rate and volume of runoff for the specified design storms, and (ix) documentation of sources for all computation methods and field test results.

### D. Soils Information

Geotechnical properties for the hydrologic and structural properties of soils, especially for dam embankments, shall be described in a soils report. The submitted report shall

include boring depth, sampling frequency & types and associated laboratory testing with results and conclusions and follow the criteria in the Virginia Stormwater Management Manual (or local equivalent). Soil properties for infiltration facilities shall also conform to the guidance and specification outlined in the Virginia Stormwater Management Manual (or local equivalent).

E. Maintenance Plan

The design and planning of all stormwater management facilities shall include detailed maintenance procedures to ensure their continued function. These plans will identify the parts or components of a stormwater management facility that need to be maintained and the equipment and skills or training necessary. Provisions for the periodic review and evaluation of the effectiveness of the maintenance program and the need for revisions or additional maintenance procedures shall be included in the plan.

F. Landscaping plan

The applicant must present a detailed landscaping plan describing the woody and herbaceous vegetative stabilization and management techniques to be used within and adjacent to the stormwater practice. The landscaping plan must also describe who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved. This plan must be prepared by a qualified individual familiar with the selection of emergent and upland vegetation appropriate for the selected BMP.

G. Maintenance Easements

The applicant must ensure access to all stormwater treatment practices at the site for the purpose of inspection and repair by securing all the maintenance easements needed on a permanent basis. These easements will be recorded with the plan and will remain in effect even with transfer of title to the property. See Section 3.4

H. Maintenance Agreement

The applicant must execute an easement and an inspection and maintenance agreement binding on all subsequent owners of land served by an on-site stormwater management measure in accordance with the specifications of this ordinance. See Section 3.4

I. Erosion and Sediment Control Plans for Construction of Stormwater Management Measures

The applicant must prepare an erosion and sediment control plan in accordance with the Virginia Erosion and Sediment Control Minimum Standards (4VAC50-30-40) (or reference to local Erosion and Sediment Control Ordinance) for all construction activities related to implementing any on-site stormwater management practices.

#### J. Other Environmental Permits

The applicant shall assure that all other applicable environmental permits have been acquired for the site prior to approval of the final stormwater design plan.

### 3.4. Stormwater Facility Maintenance Agreements

Prior to the issuance of any permit that has a stormwater management facility as one of the requirements of the permit, the applicant or owner of the site must execute a maintenance easement agreement and a formal maintenance covenant that shall be binding on all subsequent owners of land served by the stormwater management facility.

#### 1. Maintenance Easement Agreement

The Maintenance Easement Agreement shall provide for access to the stormwater management facility at reasonable times for periodic inspection by the \_\_\_\_\_(jurisdictional stormwater authority), or their contractor or agent, and for regular or special assessments of property owners to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by this ordinance. The easement agreement shall be recorded by the \_\_\_\_\_(jurisdictional stormwater authority) in the land records.

When any new drainage control facility is installed on private property, or when any new connection is made between private property and a public drainage control system, the property owner shall grant, after given notice and the opportunity to accompany the inspection, to the \_\_\_\_\_(jurisdictional stormwater authority) the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection. This includes the right to enter a property when it has a reasonable basis to believe that a violation of this ordinance is occurring or has occurred, and to enter when necessary for abatement of a public nuisance or correction of a violation of this ordinance.

#### 2. Maintenance Covenants

Maintenance of all stormwater management facilities shall be ensured through the creation of a formal maintenance covenant that must be approved by the \_\_\_\_\_(jurisdictional stormwater authority) and recorded into the land record prior to final plan approval. The covenant shall identify by name or official title the person(s) responsible for carrying out the maintenance. Responsibility for the operation and maintenance of stormwater management facilities, unless assumed by a governmental agency, shall remain with the property owner and shall pass to any successor or owner. If portions of the land are to be sold, legally binding arrangements shall be made to pass the basic responsibility to successors in title. These arrangements shall designate for each property owner, governmental agency, or other legally established entity to be permanently responsible for maintenance. As part of the covenant, a schedule shall be developed for when and how often maintenance will occur to ensure proper function of the stormwater management facility. The covenant shall also include plans for annual



inspections to ensure proper performance of the facility between scheduled maintenance and should also include “failure to maintain” provisions.

In the event that maintenance or repair is neglected, or the stormwater management facility becomes a danger to public health or safety, \_\_\_\_\_ (jurisdictional stormwater authority) reserves the authority to perform the work and to recover the costs from the owner.

The \_\_\_\_\_ (jurisdictional stormwater authority), in lieu of an maintenance covenant, may accept dedication of any existing or future stormwater management facility for maintenance, provided such facility meets all the requirements of this Section and includes adequate and perpetual access and sufficient area, by easement or otherwise, for inspection and regular maintenance.

*5 The local ordinance should provide the process by which the locality will recover costs from the owner for carrying out maintenance activities.*

*5 Maintenance covenants should include a recommended annual inspection frequency, as well as after any storm events which cause the capacity of the principal spillway to be exceeded. This will help keep routine maintenance needs from evolving into major and costly repairs.*

### **3.5 Performance Bonds**

The \_\_\_\_\_ (jurisdictional stormwater authority) may, at its discretion, require the submittal of a performance security or bond with surety, cash escrow, letter of credit or such other acceptable legal arrangement prior to issuance of a permit in order to insure that the stormwater practices are installed by the permit holder as required by the approved stormwater management plan.

1. The amount of the installation performance security shall be the total estimated construction cost of the stormwater management practices approved under the permit, plus 25%.

2. The performance security shall contain forfeiture provisions for failure, after proper notice, to complete work within the time specified, or to initiate or maintain appropriate actions which may be required of the applicant in accordance with the approved stormwater management plan.

3. If the \_\_\_\_\_ (jurisdictional stormwater authority) takes such action upon such failure by the applicant, the \_\_\_\_\_ (jurisdictional stormwater authority) may collect from the applicant for the difference should the amount of the reasonable cost of such action exceed the amount of the security held.

4. Within sixty days of the completion of the requirements of the approved stormwater management plan in the form of certified as-built report and survey, such bond, cash escrow, letter of credit or other legal arrangement, except for the landscaping survivability shall be refunded to the applicant or terminated.

5. The landscaping portion of the stormwater management plan shall be inspected one (1) year after installation with replacement in accordance with the final plans and specifications prior to final release.

6. These requirements are in addition to all other provisions of \_\_\_\_\_ (jurisdictional stormwater authority) ordinances relating to the issuance of such plans and are not intended to otherwise affect the requirements for such plans.

*5 Some communities elect to also require a maintenance performance security. This bond typically is set at the maintenance costs estimated in the stormwater plan for the period during which the permit holder has maintenance responsibility and is released when the responsibility for practice maintenance is passed on to another party, via an approved maintenance agreement.*

### **3.6. Permit Application Review Fees**

Applicants shall submit a permit fee to \_\_\_\_\_ (jurisdictional stormwater authority) in according with the following provisions:

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(jurisdictional stormwater authority to insert specific review fee schedule as appropriate).

*5 According to Virginia Law, the fee for review of any land development application shall be based on the cost of program administration, including costs associated with plan review, issuance of permits, periodic inspection for compliance with approved plans, and necessary enforcement, provided that charges for such costs are not made under any other law, ordinance or program. The fee shall not exceed an amount commensurate with the services rendered and expenses incurred or \$1,000, whichever is less and shall be made prior to the issuance of any building permit for the development. In some cases this fee limit may not be enough to fully cover the costs of large projects or multiple reviews. Further, many localities have developed a fee schedule and use the statutory authority for recovery of costs from other development related laws, such as Virginia Erosion and Sediment Control, Zoning, and Subdivision to authorize appropriate fees within the overall development review process.*

**3.7. Permit Application Procedure**

1. Applications for land disturbance activity permits must be filed with the \_\_\_\_\_ (appropriate review agency) on any regular business day.
2. A copy of this permit application shall be forwarded to \_\_\_\_\_ (jurisdictional stormwater authority) for review.
3. Permit applications shall include the following: two copies of the stormwater management concept plan, two copies of the maintenance agreement, and any required review fees.
4. Within 60 calendar days of the receipt of a complete permit application, including all documents as required by this ordinance, the \_\_\_\_\_ (jurisdictional stormwater authority) shall inform the applicant whether the application, plan and maintenance agreement are approved or disapproved.
5. If the permit application, stormwater management plan or maintenance agreement are disapproved, the \_\_\_\_\_ (jurisdictional stormwater authority) shall communicate the decision to the applicant in writing. The applicant may then revise the stormwater management plan or agreement. If additional information is submitted, the \_\_\_\_\_ (jurisdictional stormwater authority) shall have 30 calendar days from the date the additional information is received to inform the applicant that the plan and maintenance agreement are either approved or disapproved.
6. If the permit application, final stormwater management plan and maintenance agreement are approved by the \_\_\_\_\_ (jurisdictional stormwater authority), the following conditions apply:
  - A. The applicant shall comply with all applicable requirements of the approved plan and this ordinance and shall certify that all land clearing, construction, land development and drainage will be done according to the approved plan.
  - B. The land development project shall be conducted only within the area specified in the approved plan.
  - C. The \_\_\_\_\_ (jurisdictional stormwater authority) shall be allowed, after giving notice to the owner, occupier or operator of the land development project, to conduct periodic inspections of the project.
  - D. The person responsible for implementing the approved plan shall conduct

monitoring and submit reports as the \_\_\_\_\_ (jurisdictional stormwater authority) may require to ensure compliance with the approved plan and to determine whether the plan provides effective stormwater management.

E. No changes may be made to an approved plan without review and written approval by the \_\_\_\_\_ (jurisdictional stormwater authority).

F. A certified inspection of all aspects of the BMP, including surface As-Built surveys, and geotechnical inspections during subsurface or backfilling and compaction activities shall be required.

*5 Jurisdictions may modify the above local review process to accommodate their current subdivision approval process, while keeping in mind that the above procedure represents the minimum standard. In addition, local officials will need to decide the appropriate time frames for review based on the number of stormwater management plans, maintenance covenants, etc. submitted, while keeping in mind the time frames for the review of initial and resubmitted applications. This will often be determined by the staff available for permit review and inspection of sites undergoing construction.*

## **Section 4. Exceptions to Stormwater Management Requirements**

### **4.1. Exceptions for Providing Stormwater Management**

Every applicant shall provide for stormwater management, unless they file a written request to waive this requirement. Requests to waive the stormwater management plan requirements shall be submitted in writing to the \_\_\_\_\_ (jurisdictional stormwater authority) for approval. An exception from the stormwater management regulations may be granted, provided that: (i) exceptions to the criteria are the minimum necessary to afford relief and (ii) reasonable and appropriate conditions shall be imposed as necessary upon any exception granted so that the intent of the Law and this ordinance are preserved.

The minimum requirements for stormwater management may be waived in whole or in part upon written request of the applicant, provided that at least one of the following conditions applies:

1. It can be demonstrated that the proposed development is not likely to impair attainment of the objectives of this ordinance.

2. Alternative minimum requirements for on-site management of stormwater discharges have been established in a stormwater management plan that has been approved by the \_\_\_\_\_ (jurisdictional stormwater authority) and that is required to be

implemented by local ordinance.

3. Provisions are made to manage stormwater by an off-site facility. The off-site facility is required to be in place, to be designed and adequately sized to provide a level of stormwater control that is equal to or greater than that which would be afforded by on-site practices and has a legally obligated entity responsible for long-term operation and maintenance of the stormwater practice.

4. The \_\_\_\_\_ (jurisdictional stormwater authority) finds that meeting the minimum on-site management requirements is not feasible due to the natural or existing physical characteristics of a site.

5. Economic hardship is not sufficient reason to grant an exception from the requirements of this chapter.

In instances where one of the conditions above applies, the \_\_\_\_\_ (jurisdictional stormwater authority) may grant a waiver from strict compliance with stormwater management provisions that are not achievable, provided that acceptable mitigation measures are provided. However, to be eligible for a variance, the applicant must demonstrate to the satisfaction of the \_\_\_\_\_ (jurisdictional stormwater authority) that the immediately downstream waterways will not be subject to:

1. Deterioration of existing culverts, bridges, dams, and other structures;
2. Deterioration of biological functions or habitat;
3. Accelerated streambank or streambed erosion or siltation;
4. Increased threat of flood damage to public health, life and property.

5 *The local jurisdictional stormwater authority may adopt other options in the ordinance as long as they are supported by a regional prioritization plan and adopted through a public process. Various types of “in-lieu-of” on-site stormwater management measures may include, but are not limited to, the following:*

- *The purchase and donation of privately owned lands, or the grant of an easement to be dedicated for preservation and/or reforestation. These lands should be located adjacent to the stream corridor in order to provide permanent buffer areas to protect water quality and aquatic habitat;*
- *The creation of a stormwater management facility or other drainage improvements on previously developed properties, public or private, that*

*currently lack stormwater management facilities designed and constructed in accordance with the purposes and standards of this ordinance;*

- *Monetary contributions (Fee-in-Lieu) to fund stormwater management implementation or related watershed studies including regional wetland delineation studies, stream monitoring studies for water quality and macro-invertebrates, stream flow monitoring, and threatened and endangered species studies.*

*Sample “Fee-in-Lieu” of on-site stormwater management practices ordinance language:*

*When an applicant obtains a waiver of the required stormwater management, the monetary contribution required shall be in accordance with a fee schedule (unless the developer and the stormwater authority agree on a greater alternate contribution) established by the \_\_\_\_\_ (jurisdictional stormwater authority), and based on the cubic feet of storage required for on-site stormwater management, the anticipated contribution to nonpoint source pollution, or some other appropriate measure of the development in question. All of the monetary contributions shall be credited to an appropriate capital improvements program project or approved watershed study, and shall be made by the developer prior to the issuance of any building permit for the development.*

*Sample Dedication of Land Ordinance Language:*

*In lieu of a monetary contribution, an applicant may obtain a waiver of the required stormwater management by entering into an agreement with the \_\_\_\_\_ (jurisdictional stormwater authority) for the granting of an easement or the dedication of land by the applicant, to be used for the construction of an off-site stormwater management facility. The agreement shall be entered into by the applicant and the \_\_\_\_\_ (jurisdictional stormwater authority) prior to the recording of plats or, if no record plat is required, prior to the issuance of the building permit.*

## **Section 5. General Criteria for Stormwater Management**

*5 The following sections provide performance or outcome based criteria that directs applicants in the selection, design, and implementation of stormwater Best Management Practices. Rather than place specific stormwater hydrologic and BMP design criteria into an ordinance, it is often preferable to reference these requirements in a separate stormwater management design manual such as the Virginia Stormwater Management Handbook. This allows specific design*

*information to change over time as new information or techniques become available without requiring the formal process needed to change ordinance language. The ordinance can then require those submitting any development application to consult the current edition of the referenced stormwater management handbook or design manual for the exact design criteria for practices appropriate for their site.*

The following technical criteria shall be applied on all applicable land development and land conversion activities.

## **5.1 General**

1. Determination of flooding and channel erosion impacts to receiving streams due to land development projects shall be measured at each point of discharge from the development project and such determination shall include any runoff from the balance of the watershed which also contributes to that point of discharge.

2. The specified design storms shall be defined as either a 24-hour storm using the rainfall distribution recommended by the U.S. Soil Conservation Service when using U.S. Soil Conservation Service methods or as the storm of critical duration that produces the greatest required storage volume at the site when using a design method such as the Modified Rational Method. Pre-development and post-development runoff rates shall be verified by calculations that are consistent with good engineering practices.

*5 These methods represent the generally accepted hydrologic criteria. The importance of specifying a methodology is to maintain consistency within a watershed. Local governments may choose to specify alternate criteria for specific watersheds. Alternate criteria should be documented and submitted to DCR for review, and presented to the local development and consulting community for comment.*

3. For purposes of computing runoff, all pervious lands in the site shall be assumed prior to development to be in good condition (if the lands are pastures, lawns, or parks), with good cover (if the lands are woods), or with conservation treatment (if the lands are cultivated); regardless of conditions existing at the time of computation.

4. Construction of stormwater management facilities or modifications to channels shall comply with all applicable laws and regulations. Evidence of approval of all necessary permits, such as US Army Corps of Engineers and VA DEQ Wetland Permits, VA DEQ VPDES Permits, etc., shall be presented.

5. Impounding structures that are not covered by the Impounding Structure Regulations (4 VAC 50-20-10 et seq.) shall be engineered for structural integrity during the 100-year storm

event.

6. Pre-development and post-development runoff rates shall be verified by calculations that are consistent with good engineering practices.

7. Outflows from a stormwater management facility shall be discharged to an adequate channel, and velocity dissipaters shall be placed at the outfall of all stormwater management facilities and along the length of any outfall channel as necessary to provide a nonerosive velocity of flow from the basin to a channel.

8. Proposed residential, commercial, or industrial subdivisions shall apply these stormwater management criteria to the land development as a whole. Individual lots in new subdivisions shall not be considered separate land development projects, but rather the entire subdivision shall be considered a single land development project. Hydrologic parameters shall reflect the ultimate land development and shall be used in all engineering calculations.

9. All stormwater management facilities shall have a maintenance plan which identifies the owner and the responsible party for carrying out the maintenance plan.

10. Construction of stormwater management impoundment structures within a Federal Emergency Management Agency (FEMA) designated 100-year floodplain shall be avoided to the extent possible. When this is unavoidable, all stormwater management facility construction shall be in compliance with all applicable regulations under the National Flood Insurance Program, 44 CFR Part 59.

11. Natural channel characteristics shall be preserved to the maximum extent practicable.

12. Land development projects shall comply with the Virginia Erosion and Sediment Control Law and attendant regulations (*or this ordinance*).

13. Non-Structural Stormwater Practices designed to reduce the volume of stormwater runoff are encouraged to reduce the amount of stormwater runoff that must be managed. This will help to minimize the reliance on structural practices which require ongoing maintenance in order to be effective.

*5 The use of non-structural stormwater practices has gained acceptance in recent years and now includes a wide variety of ideas ranging from subdivision layout to street sweeping practices to public education. Localities are encouraged to explore all of these options and incorporate these ideas into the early stages of the development process (stormwater concept plan): preliminary planning, zoning, subdivision standards. In addition, since non-structural practices*



*tend to reduce the reliance on structural BMPs, and therefore reduce long term maintenance and inspection costs, localities should seek ways to incorporate incentives for implementing non-structural stormwater practices. Additional information and references can be found in Better Site Design - An Assessment of the Better Site Design Principles for Communities Implementing Virginia's Chesapeake Bay Preservation Act, 2000, published by the Chesapeake Bay Local Assistance Department. These practices should be researched to identify those which are appropriate for the various land uses and zoning categories within their jurisdiction.*

## **5.2 Structural Stormwater Management Practices**

### **1. Minimum Control Requirements**

All stormwater management practices shall be designed so that the specific storm frequency storage volumes (e.g., water quality, channel protection, 10 year, 100 year) as identified in the current Virginia Stormwater Management Handbook are met, unless the \_\_\_\_\_ (jurisdictional stormwater authority) grants the applicant a waiver or the applicant is exempt from such requirements.

In addition, if hydrologic or topographic conditions warrant greater control than that provided by the minimum control requirements, the \_\_\_\_\_ (jurisdictional stormwater authority) reserves the right to impose any and all additional requirements deemed necessary to protect downstream properties and aquatic resources from damage due to increased volume, frequency, and rate of stormwater runoff.

*5 Local governments are encouraged to assess their watersheds and aquatic resources so as to establish alternate criteria aimed at protecting or restoring watershed features. The VSWML authorizes local governments to adopt more stringent stormwater management regulations than those necessary to ensure compliance with the Board's minimum regulations, with the exception of regulations related to plan approval, provided that the more stringent regulations are based upon the findings of local comprehensive watershed management studies and that prior to adopting more stringent regulations a public hearing is held after giving due notice. (10.1-603.7.)*

### **2. Site Design Feasibility**

Stormwater management practices for a site shall be chosen based on the physical conditions of the site. Among the factors that should be considered:

- A. Topography
- B. Maximum Drainage Area
- C. Depth to Water Table
- D. Soils
- E. Slopes

- F. Terrain
- G. Hydraulic Head
- H. Location in relation to environmentally sensitive features or ultra-urban areas

Applicants shall consult the Virginia Stormwater Management Handbook (or local equivalent) for guidance on the factors that determine site design feasibility when selecting a stormwater management practice.

### 3. Conveyance Issues

All stormwater management practices shall be designed to convey stormwater to allow for the maximum removal of pollutants and reduction in flow velocities. This shall include, but not be limited to:

- A. Maximizing of flowpaths from inflow points to outflow points
- B. Protection of inlet and outfall structures
- C. Elimination of erosive flow velocities
- D. Providing of underdrain systems, where applicable

The Virginia Stormwater Management Manual (or local equivalent) provides detailed guidance on the requirements for conveyance for each of the approved stormwater management practices.

### 4. Pretreatment Requirements

Every stormwater treatment practice shall have an acceptable form of water quality pretreatment, in accordance with the pretreatment requirements found in the current Virginia Stormwater Management Handbook (or local equivalent). Stormwater infiltration practices, or practices having an infiltration component, as specified in the Virginia Stormwater Management Handbook (or local equivalent), are prohibited, even with pretreatment, in the following circumstances:

- A. Where stormwater is generated from highly contaminated source areas known as “hotspots”
- B. Where stormwater is carried in a conveyance system that also carries contaminated, non-stormwater discharges
- C. Where stormwater is being managed in a designated groundwater recharge area.
- D. Under certain geologic conditions (e.g., karst) that prohibit the proper pretreatment of stormwater

#### 5. Treatment/Geometry Conditions

All stormwater management practices shall be designed to capture and treat stormwater runoff according to the specifications outlined in the Virginia Stormwater Management Handbook (or local equivalent). These specifications will designate the water quality treatment and water quantity criteria that apply to an approved stormwater management practice (see Section 5.4, 5.5, and 5.6 of this Ordinance for specific criteria).

#### 6. Landscaping Plans Required

All stormwater management practices must have a landscaping plan detailing both the vegetation to be in the practice and how and who will manage and maintain this vegetation. This plan must be prepared by a qualified individual familiar with the selection of emergent and upland vegetation appropriate for the selected BMP.

*5 The Virginia Stormwater Management Manual Section 3.05 provides guidance in the plant selection and planting zone location for both within and surrounding the stormwater management facility. The vegetation strategy can produce an aesthetically pleasing facility while simultaneously augmenting pollutant removal capabilities and wildlife habitat.*

#### 7. Maintenance Agreements

A legally binding covenant specifying the parties responsible for the proper maintenance of all stormwater treatment practices shall be secured prior to issuance of any permits for land disturbance activities. In addition, all stormwater treatment practices shall have an enforceable operation and maintenance agreement to ensure the system functions as designed. This agreement will include any and all maintenance easements required for \_\_\_\_\_ (jurisdictional stormwater authority) to access and inspect the stormwater treatment practices. (See Section 3.4 of this Ordinance for specific maintenance provisions).

### 5.3 Water Quality

Unless judged by the \_\_\_\_\_ (jurisdictional stormwater authority) for a project to be exempt, the following criteria shall be addressed for stormwater management at all sites:

1. All stormwater runoff generated from land development and land use conversion activities shall not discharge untreated stormwater runoff directly into a jurisdictional wetland or local water body without adequate treatment. Where such discharges are proposed, the impact of the proposal on wetland functions shall be assessed using a method acceptable to the \_\_\_\_\_ (jurisdictional stormwater authority). In no case shall the impact on functions be any less than allowed by the Army Corp of Engineers (ACE) or the Department of Environmental Quality.

2. Annual groundwater recharge rates shall be maintained, by promoting infiltration through the use of structural and non-structural methods. At a minimum, annual recharge from the post development site shall mimic the annual recharge from pre-development site conditions.

5 *Recharge is a relatively new stormwater criteria, and the Virginia Stormwater Management Handbook provides design guidance for infiltration practices. Recharge criteria requires considerable effort to use existing pervious areas for stormwater treatment and infiltration, which means that it must be considered very early in the site design process when basic decisions about layout and vegetative cover are made. Land use decisions should aim to preserve areas of natural recharge ( Hydrologic Soil Group A). Providing groundwater recharge in developed areas is difficult due to the potential for clogging of natural soil porosity by urban pollutants. Infiltrating runoff from stormwater hotspots should be prohibited. Local jurisdictions may elect to incorporate a formal recharge criteria. A possible methodology for a groundwater recharge criteria is available for review and downloading in the Manual Builder at [www.stormwatercenter.net](http://www.stormwatercenter.net).*

3. Land development projects shall comply with the water quality Performance-based or Technology-based criteria in accordance with the following:

A. **Performance-based criteria.** For land development, the calculated post-development nonpoint source pollutant runoff load shall be compared to the calculated pre-development load based upon the average land cover condition or the existing site condition. A BMP shall be located, designed, and maintained to achieve the target pollutant removal efficiencies specified in Table 1 to effectively reduce the pollutant load to the required level based upon the following four applicable land development situations for which the performance criteria apply:

1. Situation 1 consists of land development where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover which is less than the average land cover condition.

Requirement: No reduction in the after development pollutant discharge is required.

2. Situation 2 consists of land development where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover which is greater than the average land cover condition.

Requirement: The pollutant discharge after development shall not exceed the existing pollutant discharge based on the average land cover condition.

3. Situation 3 consists of land development where the existing percent impervious cover is greater than the average land cover condition.

Requirement: The pollutant discharge after development shall not exceed (i) the pollutant discharge based on existing conditions less 10% or (ii) the pollutant discharge based on the average land cover condition, whichever is greater.

4. Situation 4 consists of land development where the existing percent impervious cover is served by an existing stormwater management BMP that addresses water quality.

Requirement: The pollutant discharge after development shall not exceed the existing pollutant discharge based on the existing percent impervious cover while served by the existing BMP. The existing BMP shall be shown to have been designed and constructed in accordance with proper design standards and specifications, and to be in proper functioning condition.

Table 1 \*

Water Quality BMP	Target Phosphorus Removal Efficiency	Percent Impervious Cover
Vegetated filter strip	10%	16-21%
Grassed swale	15%	
Constructed wetlands	30%	22 -37%
Extended detention (2 x WQ Vol)	35%	
Retention basin I (3 x WQ Vol)	40%	
Bioretention basin	50%	38 -66%
Bioretention filter	50%	
Extended detention-enhanced	50%	
Retention basin II (4 x WQ Vol)	50%	
Infiltration (1 x WQ Vol)	50%	
Sand filter	65%	67 -100%
Infiltration (2 x WQ Vol)	65%	
Retention basin III (4 x WQ Vol with aquatic bench)	65%	

\* Innovative or alternate BMPs not included in this table may be allowed at the discretion of the local program authority. Innovative or alternate BMPs not included in this table which target appropriate nonpoint source pollution other than phosphorous (such as petroleum, hydrocarbons, sediment, etc.) may be allowed at the discretion of the local program authority.

**C. Technology-based criteria.** For land development, the post-developed stormwater runoff from the impervious cover shall be treated by an appropriate BMP as required by the post-developed condition percent impervious cover as specified in Table 1. The selected BMP shall be located, designed, and maintained to perform at the target pollutant removal efficiency specified in Table 1. Design standards and specifications for the BMPs in Table 1 which meet the required target pollutant removal efficiency shall be consistent with those provided in the Virginia Stormwater Management Handbook.

*5 The goal of the Technology-based criteria as it is presented in Table 1 is to establish a BMP selection process consistent with the Performance-based criteria based on the BMP target pollutant removal capabilities. Appendix A presents a comparison of these two methods and how they should be applied to maintain consistency.*

*It is always recommended to isolate and treat the sources of pollution. When controlling nonpoint source (NPS) pollution from developed areas it is desirable to isolate and treat the impervious surfaces (not to imply that managed pervious areas do not contribute to NPS pollution, however, a greater concentration of pollutants resulting from a significantly greater number of storm events will be generated from impervious cover). When the impervious areas are successfully isolated the resulting percent impervious cover will approach 100%. The "Percent Impervious Cover" column in Table 1 is not meant to require that BMPs in the 67-100% category be used when the small impervious areas are isolated. Rather, the "Percent Impervious Cover" is intended to govern the selection of stand alone BMPs that are designed to control the entire developed area. When small areas of impervious cover are isolated as part of a multiple BMP strategy (such as multiple drainage areas that do not drain to the main BMP), the area should be controlled by an appropriate BMP based on the site specific conditions. For example, a small portion of a large development site, consisting of a perimeter parking area, that drains away from the main BMP can be treated by a filter strip, water quality or grass swale, or a bioretention facility designed in accordance with the Virginia Stormwater Management Handbook. The adequacy of the combination of BMPs can be verified by the Performance-based criteria. However, in jurisdictions where the water quality criteria is limited to the technology approach, an effort to treat all of the impervious surfaces with appropriately designed BMPs (drainage area, pre-treatment, slope, soils, water table, etc) should be considered.*

4. Stormwater discharges to critical areas with sensitive resources (i.e., cold water fisheries, shellfish beds, swimming beaches, recharge areas, water supply reservoirs) may be subject to additional criteria, or may need to utilize or restrict certain stormwater management practices at the discretion of \_\_\_\_\_ (jurisdictional stormwater authority).

5. Industrial sites which are listed under the Standard Industrial Code for are required to prepare and implement a stormwater pollution prevention plan, and shall file a notice of intent

(NOI) under the provisions of the National Pollutant Discharge Elimination System (NPDES) general permit. The stormwater pollution prevention plan requirement applies to both existing and new industrial sites.

5 *Applicants and local communities can consult the Environmental Protection Agency website at <http://www.epa.gov/owm/swm/phase2> for more information on NPDES Phase I and Phase II requirements.*

6. Stormwater discharges from land uses or activities with higher potential pollutant loadings, known as “hotspots”, may require the use of specific structural BMPs and pollution prevention practices.

5 *A listing of “hotspot” land uses is available in Chapter 2 of the Virginia Stormwater Management Handbook.*

7. Prior to design, applicants are required to consult with the \_\_\_\_\_ (jurisdictional stormwater authority) to determine if they are subject to additional stormwater design requirements.

#### **5.4 Stream Channel Erosion**

To protect stream channels from degradation, a specific channel protection criteria shall be provided as prescribed in the Virginia Stormwater Management Handbook (or local equivalent) and Virginia Sediment and Erosion Control regulations.

1. Properties and receiving waterways downstream of any land development project shall be protected from erosion and damage due to increases in volume, velocity and frequency of peak flow rate of stormwater runoff in accordance with the minimum design standards set out in this section.

2. The plan approving authority shall require compliance with subdivision 19 of 4 VAC 50-30-40 of the Erosion and Sediment Control Regulations, promulgated pursuant to Article 4 (§ 10.1-560 et seq.) of Chapter 5 of Title 10.1 of the Code of Virginia.

3. The plan approving authority may determine that some watersheds or receiving stream systems require enhanced criteria in order to address the increased frequency of bankfull flow conditions brought on by land development projects. Therefore, in lieu of the reduction of the 2-year post-developed peak rate of runoff as required in subsection 2 of this section, the land development project being considered shall provide 24-hour extended detention of the runoff generated by the 1-year, 24-hour duration storm.

4. In addition to subsections 2 and 3 of this section, localities may, by ordinance, adopt more stringent channel analysis criteria or design standards to ensure that the natural level of channel erosion, to the maximum extent practicable, will not increase due to the land development projects. These criteria may include, but are not limited to, the following:

- A. Criteria and procedures for channel analysis and classification.
- B. Procedures for channel data collection.
- C. Criteria and procedures for the determination of the magnitude and frequency of natural sediment transport loads.
- D.. Criteria for the selection of proposed natural or man-made channel linings.

*5 There are several alternative criteria for establishing channel protection criteria for stream channel erosion mitigation. These are listed in Appendix B.*

## **5.5 Flooding**

The calculations for determining peak flows as found in the Virginia Stormwater Management Handbook (or local equivalent) shall be used for sizing all stormwater management practices.

- 1. Downstream properties and waterways shall be protected from damages from localized flooding due to increases in volume, velocity and peak flow rate of stormwater runoff in accordance with the minimum design standards set out in this section.
- 2. The 10-year post-developed peak rate of runoff from the development site shall not exceed the 10-year pre-developed peak rate of runoff.
- 3. In lieu of subsection 2 of this section, localities may, by ordinance, adopt alternate design criteria based upon geographic, land use, topographic, geologic factors or other downstream conveyance factors as appropriate.
- 4. Linear development projects shall not be required to control post-developed stormwater runoff for flooding, except in accordance with a watershed or regional stormwater management plan.

## **5.6 Regional Stormwater Management Plans**

Applicants are directed to communicate with \_\_\_\_\_(jurisdictional stormwater authority)



prior to submitting an application for stormwater management plan approval in accordance with Section 3 of this ordinance to determine if a Regional Stormwater Management Plan has been developed for the applicable watershed. If such a plan is in existence, the applicant must provide stormwater management water quality treatment on-site in accordance with the provisions of the regional plan, and other management provisions as specified by the \_\_\_\_\_ (jurisdictional stormwater authority).

## **Section 6. Construction Inspection**

Stormwater management construction inspection shall utilize the final approved plans and specifications for compliance. In addition, the inspection shall comply with latest version of the Erosion and Sediment Control Regulations, promulgated pursuant to Article 4 (§ 10.1-566) of Chapter 5 of Title 10.1 of the Code of Virginia..

### **6.1. Notice of Construction Commencement**

The applicant must notify the \_\_\_\_\_ (jurisdictional stormwater authority) in advance before the commencement of construction. In addition, the applicant must notify the \_\_\_\_\_ (jurisdictional stormwater authority) in advance of construction of critical components of the SWM facility. Periodic inspections of the stormwater management system construction shall be conducted by the staff of the \_\_\_\_\_ (jurisdictional stormwater authority) or a professional engineer or their designee who has been approved by the jurisdictional stormwater authority. Upon completion, the applicant is responsible for certifying that the completed project is in accordance with the approved plans and specifications (refer to As-built Plans - Section 6.2) and shall provide regular inspections sufficient to adequately document compliance. All inspections shall be documented and written reports prepared that contain the following information:

1. The date and location of the inspection;
2. Whether construction is in compliance with the approved stormwater management plan;
3. Variations from the approved construction specifications; and
4. Any violations that exist.

If any violations are found, the property owner shall be notified in writing of the nature of the violation and the required corrective actions. No additional work shall proceed until any violations are corrected and all work previously completed has received approval by the \_\_\_\_\_ (jurisdictional stormwater authority).

In addition, the person responsible for carrying out the plan may be required to provide inspection monitoring and reports to ensure compliance with the approved plan and to determine whether the measures required in the plan provide effective stormwater management.

If the \_\_\_\_\_ (jurisdictional stormwater authority) determines that there is a failure to comply with the plan, notice shall be served upon the permittee or person responsible for carrying out the plan in accordance with Section 8 of this Ordinance.

*5 Construction inspection frequency should be consistent with VPDES and local/state regulations.*

## **6.2. Post-Construction Final Inspection and As-Built Plans**

All applicants are required to submit actual “as built” plans for any stormwater management practices located on-site after final construction is completed. The plan must show the final design specifications for all stormwater management facilities and must be certified by a professional engineer. A final inspection by the \_\_\_\_\_ (jurisdictional stormwater authority) is required before the release of any performance securities can occur. A certified inspection of all aspects of the BMP construction is required, including surface As-Built surveys, and geotechnical inspections during subsurface or backfilling, riser & principal spillway installation, bioretention soil placement and compaction activities.

*5 As-Built requirements should be based on an a checklist to ensure proper survey of surface and sub-surface features. The Virginia Stormwater Management Handbook, Chapter 3 - Appendix.*

## **Section 7. Maintenance Inspection and Repair of Stormwater Facilities**

### **7.1. Maintenance Inspection of Stormwater Facilities**

All stormwater management facilities must undergo inspections to document maintenance and repair needs and ensure compliance with the requirements of this ordinance and accomplishment of its purposes. These needs may include; removal of silt, litter and other debris from all catch basins, inlets and drainage pipes, grass cutting and vegetation removal, and necessary replacement of landscape vegetation and any repair or replacement of structural features.

At a minimum, a stormwater management facility shall be inspected on an annual basis by \_\_\_\_\_ (jurisdictional stormwater authority) In the event that the stormwater management facility has not been maintained and/or becomes a danger to public safety or public health, the \_\_\_\_\_ (jurisdictional stormwater authority) shall notify the person responsible for carrying out the maintenance plan by registered or certified mail to the address specified in the maintenance covenant. The notice shall specify the measures needed to comply with the plan and shall specify the time within which such measures shall be completed. If the responsible party fails or refuses to meet the requirements of the maintenance covenant, the \_\_\_\_\_ (jurisdictional stormwater authority), after reasonable notice, may correct a violation of the design standards or maintenance needs by performing all necessary work to place the facility in proper working condition, and recover the costs

from the owner.

*5 The Virginia Stormwater Regulations require localities to inspect stormwater facilities on an annual basis. Depending on available manpower to ensure such a schedule, localities may establish an alternative inspection schedule based upon a system of priorities as provided in the Regulations (4VAC3-20-141).*

## **7.2 Records of Maintenance and Repair Activities.**

Parties responsible for the operation and maintenance of a stormwater management facility shall make records of the installation and of all maintenance and repairs, and shall retain the records for at least \_\_\_\_ years. These records shall be made available to the \_\_\_\_\_ (jurisdictional stormwater authority) during inspection of the facility and at other reasonable times upon request.

## **Section 8. Enforcement and Penalties.**

### **8.1. Violations**

Any development activity that is commenced or is conducted contrary to this Ordinance or the approved plans and permit, may be subject to the enforcement actions outlined in this section and the Virginia Stormwater Management Law

### **8.2. Notice of Violation**

When the \_\_\_\_\_ (jurisdictional stormwater authority) determines that an activity is not being carried out in accordance with the requirements of this Ordinance, it shall issue a written notice of violation delivered by registered or certified mail to the applicant. The notice of violation shall contain:

1. The name and address of the applicant;
2. The address when available or a description of the building, structure or land upon which the violation is occurring;
3. A statement specifying the nature of the violation;
4. A description of the remedial measures necessary to bring the development activity into compliance with this Ordinance and a time schedule for the completion of such remedial action;
5. A statement of the penalty or penalties that shall or may be assessed against the person to whom the notice of violation is directed;

6. A statement that the determination of violation may be appealed to the municipality by filing a written notice of appeal within thirty (30) days of service of notice of violation.

### **8.3. Stop Work Orders**

Persons receiving a notice of violation will be required to halt all construction activities. This “stop work order” will be in effect until the \_\_\_\_\_ (jurisdictional stormwater authority) confirms that the development activity is in compliance and the violation has been satisfactorily addressed. Upon failure to comply within the time specified, the permit may be revoked and the applicant shall be deemed to be in violation of this article and upon conviction shall be subject to the penalties provided by this Ordinance - Section 9.4.

### **8.4. Civil and Criminal Penalties**

Any person who violates any provision of a local ordinance or program adopted pursuant to the authority of this article shall be guilty of a Class 1 misdemeanor and shall be subject to a fine not exceeding \$1,000 or up to thirty days imprisonment for each violation or both. In addition \_\_\_\_\_ (jurisdictional stormwater authority) may pursue the following actions:

1. \_\_\_\_\_ (jurisdictional stormwater authority) may apply to the circuit court to enjoin a violation or a threatened violation of the provisions of this ordinance without the necessity of showing that an adequate remedy at law does not exist.
2. Without limiting the remedies which may be obtained in this section, \_\_\_\_\_ (jurisdictional stormwater authority) may bring a civil action against any person for violation of this ordinance or any condition of a permit. The action may seek the imposition of a civil penalty of not more than \$2,000 against the person for each violation.
3. With the consent of any person who has violated or failed, neglected or refused to obey this ordinance or any condition of a permit, \_\_\_\_\_ (jurisdictional stormwater authority) may provide, in an order issued by \_\_\_\_\_ (jurisdictional stormwater authority) against such person, for the payment of civil charges for violations in specific sums, not to exceed the limit specified in subdivision 2 of this section. Such civil charges shall be instead of any appropriate civil penalty which could be imposed under subdivision 2. Such a local ordinance may also include the following sanctions:

### **8.5. Restoration of Lands**

Any violator may be required to restore land to its undisturbed condition or in accordance with a Notice of Violation, Stop Work Order, or Permit requirements. In the event that restoration is not undertaken within a reasonable time after notice, the \_\_\_\_\_ (jurisdictional stormwater authority) may take necessary corrective action, the cost of which shall be covered by the performance bond, or become a lien upon the property until paid, or both.

#### **8.6. Holds on Occupation Permits**

Occupation permits shall not be granted until corrections to all stormwater practices have been made in accordance with the approved plans, Notice of Violation, Stop Work Order, or Permit requirements, and accepted by \_\_\_\_\_ (jurisdictional stormwater authority).

**Appendix A**  
**Analysis of “*Performance-based*”**  
**VS**  
**“*Technology-based*”**  
**Water Quality Criteria**

## ***Performance-based and Technology-based Approaches to Water Quality Assessment***

The Virginia Stormwater Management Regulations (SWMR) reference both a *Performance-based* and a *Technology-based* criterion for water quality assessment. The Performance-based criteria, based on the Simple Method (Refer to **Chapter 5-10** of the Virginia Stormwater Management Handbook), has been in use in Tidewater Virginia for the purposes of calculating nonpoint source (nps) pollutant load calculations and BMP implementation as required by the Chesapeake Bay Preservation Act (CBPA). The technology-based criteria has been in use as the traditional method of compliance with the SWMR, and is based on the approach of implementing what is considered to be the most appropriate or best available technology for the specific development conditions.

The 1998 amendment to the SWMR included both of these criterion with a reference to the Virginia SWM Handbook so as to provide detailed specifications and design features necessary for the proper selection of Best Management Practices (BMPs). The result is equivalent dual water quality criterion that allows for innovation in complying with the CBPA and the SWMR, and promotes BMPs that are more easily maintained and more functional in the long-term.

The *Performance-based criteria* is a simplistic method for associating pollutant loads with impervious cover, measured in percent, based on a given pollutant loading concentration. The method assumes the amount of runoff, and the corresponding nps pollutant loads, are directly proportional to the degree of impervious cover. BMPs with target pollutant removal efficiencies (as defined in Table 1 of the SWMR and designed in accordance with the SWM Handbook) are then applied to the site to reduce post-development nps pollutant loads to pre-development levels. An *average land cover condition* is assumed for the pre-developed condition in order for the Simple Method to represent a pre-developed nps pollutant load where no impervious cover may exist. (The Simple Method is based solely on impervious cover.) The *average land cover condition* represents the area of impervious cover which will generate a nps pollutant load equivalent to the weighted Chesapeake Bay watershed load (considering all land use- forested, agriculture, open, urban, etc.) at the time of adoption of the CBPA. The default value is 16% impervious cover. Some localities have increased this value to reflect the actual impervious cover within the jurisdiction at the time of local program adoption. (The reader is encouraged to refer to **Chapter 5-10** of the SWM Handbook for additional discussion of the criteria.)

The *Technology-based criteria* is a method whereby the designer, based on the characteristics of the site (drainage area size, total impervious cover, engineering constraints, etc.), selects a BMP which is the most technologically appropriate solution to reduce the post-developed nps pollutant load. The detailed BMP standards and specifications referenced in the Virginia SWM Handbook are required elements necessary to achieve the referenced target pollutant removal efficiency.

**Table 1\***  
(Virginia Stormwater Management Regulations)

Water Quality BMP	Target Phosphorus Removal Efficiency	Percent Impervious Cover
Vegetated filter strip	10%	16-21%
Grassed swale	15%	
Constructed wetlands	30%	22 -37%
Extended detention (2 x WQ Vol)	35%	
Retention basin I (3 x WQ Vol)	40%	
Bioretention basin	50%	38 -66%
Bioretention filter	50%	
Extended detention-enhanced	50%	
Retention basin II (4 x WQ Vol)	50%	
Infiltration (1 x WQ Vol)	50%	
Sand filter	65%	67 -100%
Infiltration (2 x WQ Vol)	65%	
Retention basin III (4 x WQ Vol with aquatic bench)	65%	

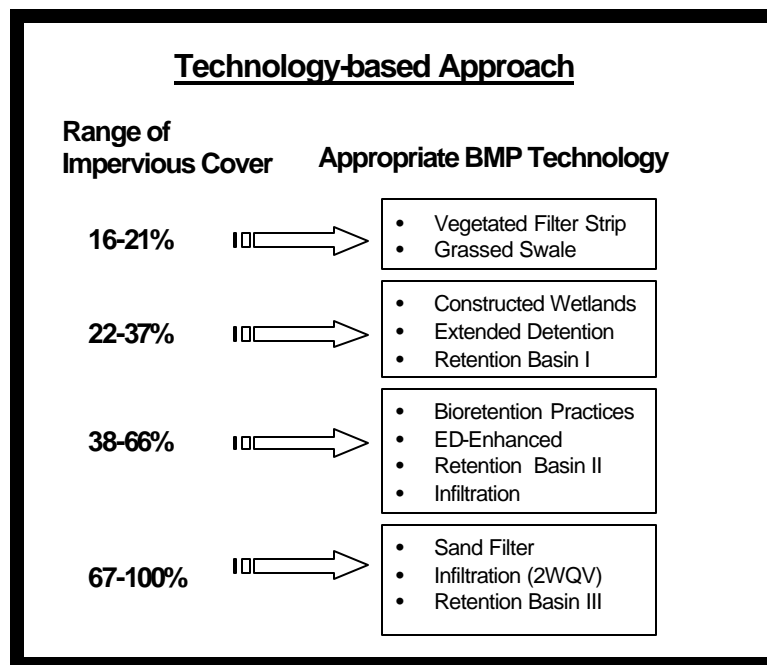
\* Innovative or alternate BMPs not included in this table may be allowed at the discretion of the local program administrator or the Department. Innovative or alternate BMPs not included in this table which target appropriate nonpoint source pollution other than phosphorous may be allowed at the discretion of the local program administrator or the Department.

It should be noted that the percent impervious cover listed in Table 1 is intended to refer to the entire drainage area (or portion of the site) to be served by a proposed BMP. In situations where the entire site does not drain to a primary BMP, the balance of the site, if covered by impervious surfaces, should be treated in some fashion by a water quality BMP. When the impervious cover of this remaining portion is isolated, the percent impervious cover will typically be near 100%. The intent of the *Technology-based criteria* is not to treat this area with a highly efficient (67-100% Impervious Cover) BMP such as a sand filter. Rather, an appropriate BMP sized for the contributing area, such as a grass swale, filter strip, bioretention, etc. should be applied in conjunction with the primary BMP. The use of Simple Method can quantify the overall benefit of the combination of BMPs applied to the site. However, some jurisdictions may choose to apply only the *Technology-based criteria* and require the maximum practical coverage of the site, thereby necessitating the use of drainage area specific BMPs, the selection of which may involve more than simply percent impervious cover.

The intent of is to shift the focus of BMP selection and design from debates over a few percentage points worth of pollutant removal efficiency to a focus on the application of the most appropriate treatment technology for the site. This approach assumes that the designer will apply sound engineering principles and specifications to the site design and will do everything practicable to reduce the pollutant loads through site



design configuration and enhancements. This becomes critical when the *Performance-based* criteria results in a required pollutant removal efficiency greater than the accepted limit of BMP technology (65% removal efficiency). The common response to such a requirement has been the implementation of multiple BMPs in series. Inherent in the *technology-based* approach is the recognition that the application of BMPs in series will often yield little additional pollutant removal benefits versus a properly designed and maintained primary BMP with design enhancements, such as pretreatment of the runoff, and a minimization of loads generated on the site. (The reader should refer to the more detailed discussion entitled “Guidance for Calculating Pollutant Load Reduction for Ponds in Series” in the Appendix D.)



There are some limitations to the application of the technology-based approach. This method may not provide the most appropriate water quality assessment in situations such as the following:

- < Multiple drainage areas on a site (not individually treated by the technology approach);
- < When multiple BMPs are employed to obtain compliance with a Regional (watershed-wide) Stormwater Analyses;
- < Sites which include: buffer equivalency calculations, redevelopment, subdivided parcels, etc.

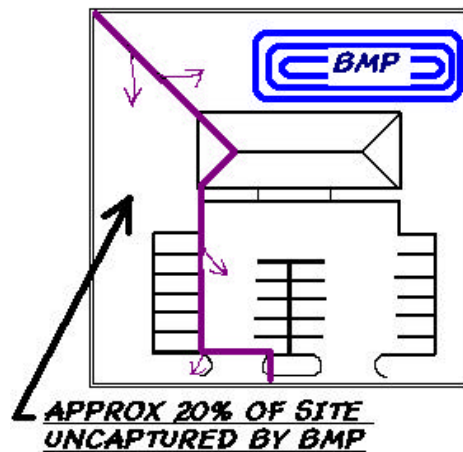
In such instances, the performance-based approach should be employed. However, where local requirements specify the use of one criteria, either method, when applied correctly, should result in an acceptable water quality design. The goal of providing two technical criterion for water quality

assessment is to encourage localities to allow reasonable adjustments to BMP efficiencies in order to provide some latitude for a well-thought out BMP plan. An unintended result is that some designers may examine the results of each method and then select the one which is least restrictive for the development being analyzed. While the two methods will generally provide similar overall results and likewise a similar degree of water-quality protection, there may be cases where the results of such a comparison will favor one method over the other. The following example problem illustrates the application of the two methods on a typical development site and the resulting design related decisions that should ultimately result in an equivalent design:

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***! Situation:*** A 3-Acre new development site will be developing from the 16% average land cover condition (assumed) to a 60% impervious cover condition. Only 80% (approximately) of the total site area can be easily captured within the proposed BMP system.

***! Goal:*** Compare the effectiveness of the Performance-based vs. Technology-based approach.



---

***Performance-based Criteria:***

Using the Performance-based procedure, calculate the pre and post-development nps pollutant loads. The pre-development nps pollutant load is based on the average land cover condition (in this case 16% impervious), and the actual post-development impervious cover.

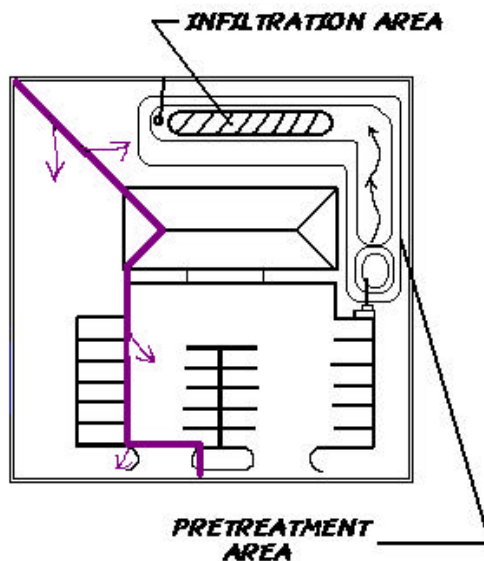
The calculated required BMP removal efficiency is approximately 67%. As indicated in Table 1 of the Regulations, the generally accepted upper limit of BMP target pollutant removal efficiency is 65%. A BMP from the fourth grouping (65% efficient) will come close, however, will still fall short of meeting

the requirement. Upon further inspection, the BMP choices in this fourth group may be limited by site constraints such as drainage area (retention basin), topography and soils (Infiltration - 2\* WQV), etc.

### ***Technology-based Criteria:***

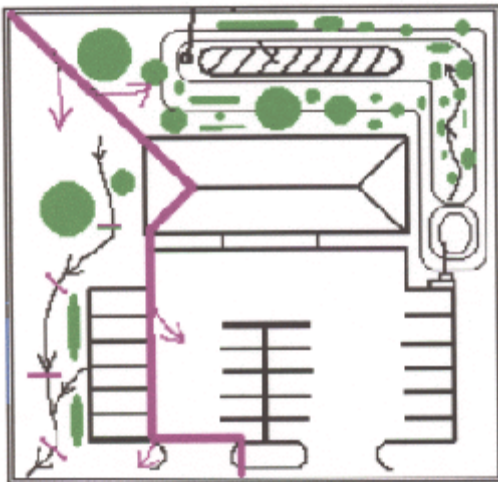
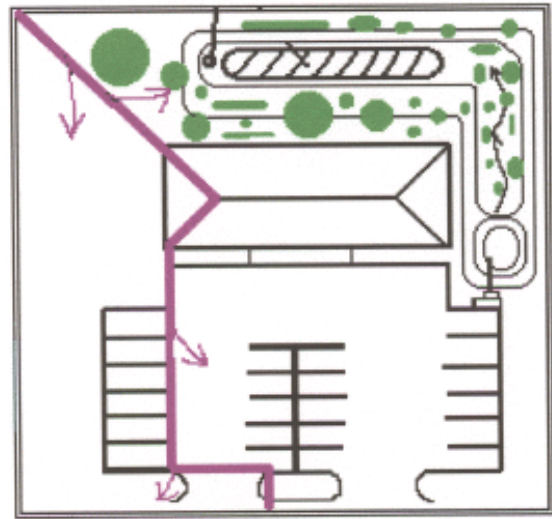
Using Table 1 from the Virginia SWMR, a 60% impervious site requires a BMP from the third grouping(50% efficient) including Bioretention, ED Enhanced, Retention Basin II, and Infiltration. In this technology-based example, infiltration (1 \* WQV) or similar BMP, based on given site constraints, is selected. If this BMP only captures approximately 80% of the site, the net result is approximately 40% pollutant removal. Guidance states that we should provide a second BMP to treat the impervious area not captured by the primary BMP, so it does not run off untreated.

The *performance-based* criteria would appear to be more stringent in requiring a higher pollutant removal than the *technology-based* criteria (67% removal required vs. 40% removal affected). However, through the implementation of sound technical standards and specifications, effective treatment should be achieved. The BMP standards and specifications for an infiltration BMP require that pretreatment measures, a landscape plan for the site and BMP buffer areas, and possibly a second BMP treating the remaining 20% be provided. (An infiltration BMP is mentioned here in keeping with the above example, however, the same can be applied to any number of different BMPs.)



***Pretreatment:*** Pretreatment is a necessary facet of most BMP plans. It helps to ensure long-term functionality of a BMP, assists in lowering maintenance costs, and generally increases their effectiveness in removing pollutants. In this case we provide a sediment forebay/marsh area near the discharge point, coupled with a meandered trapezoidal grassed swale with check dams. Under the technology-based approach, such pretreatment measures are required outright. Under the performance-based approach, a credit for additional pollutant removal for the grassed swale and forebay/ marsh is provided.

**Landscaping:** A landscape plan is an integral component of a BMP Plan. Not only does landscape assist with aesthetic concerns, a properly designed and maintained landscape plan can increase pollutant removal efficiency. In this example we have provided some vegetation in mulched landscape beds in the BMP pretreatment area, which will also provide some limited biofiltration capacity. We have also provided mulched landscape beds behind the proposed structure to filter the runoff, and remove larger particulate matter prior to entry the basin. Whereas such a landscape plan is again, required outright under the Technology-based approach, the designer could claim additional pollutant removal benefits in the form of a limited filter strip, or biofiltration under the performance approach.



**Additional Treatment:** As stated previously, areas not captured by the primary BMP should not go untreated. A secondary BMP in the form of additional landscaping and a grassed swale with check dam has been provided in the smaller drainage area. While such additional treatment is required outright by the Technology approach, the designer could claim credit for additional treatment affected through this BMP.

The application of all these design features and enhancements will typically generate a BMP plan sufficient to meet the performance-based requirements (in this case 67%). The difference is the allowance of design enhancements to satisfy the “*best available technology*” for the site. The application and strict

enforcement of the *Performance-based criteria* requirement of 67% would result in the arbitrary decision to award a higher removal requirement for the selected BMP or the need for a variance to the higher removal requirement.

### Summary

- The *technology-based criteria* represents a simpler approach to traditional BMP selection, but is accompanied by stringent standards to promote high quality Best Management Practices.
- The *technology-based criteria* requires that the most appropriate technology be placed on the site to provide a level of treatment consistent with the density of the development.
- The *technology-based criteria* requires the implementation of site and BMP design enhancements focused on reducing the nps pollutant load leaving the site.
- The local program administrator can require pretreatment and landscaping either through the multiple BMP requirements necessary to accomplish the required *performance-based criteria* load reductions, or through the *technology-based criteria* as a technical component of an efficient BMP design.
- The performance-based removal efficiencies for water quality BMPs can be marginally adjusted for very good designs which incorporate pollutant removal enhancement features such as sediment forebays, baffle systems to prevent short-circuiting, additional extended detention features, aquatic benches, micropools, etc. Likewise, the technology-based approach implements a BMP as a starting point with similar enhancement features required in order to provide the target removal efficiency.

**Appendix B**  
**Alternative**  
**Channel Protection Criteria**

## Stream Channel Protection Recommendations

Channel protection is a relatively new criteria, but is increasingly viewed as a critical one due to the mounting evidence that stream channels enlarge in response to watershed development. Studies have found higher bank erosion rates and increased instream sediment loads for urban streams when compared to the 5-20% estimate for the annual sediment budget attributable to bank erosion in rural streams (Walling and Woodward, 1995; Collins et al., 1997). Research also indicates that channel enlargement can begin at a relatively low level of watershed development, as indicated by the amount of impervious cover. One study estimated that channel erosion rates were three to six times higher in a moderately urbanized watershed (14% impervious cover) than in a comparable rural one, with less than 2% impervious cover (Neller, 1988).

The basic methodology to calculate channel enlargement relies on obtaining historical cross-sectional data from past surveys (often obtained from transportation agencies or public works departments that conducted surveys at the time of road construction or improvement projects) and comparing these with current cross-sectional data obtained from field surveys conducted at the time of the study. The approach also utilizes predictive (i.e., empirical) equations to estimate an ultimate channel enlargement ratio once the channel has enlarged sufficiently to be in balance with its hydrological forces.

### Basic Options for Stream Channel Protection

As many as five different design criteria have been suggested to protect downstream channels from erosion. It should be clearly noted that none of these criteria have yet been monitored in the field to demonstrate their effectiveness, and most are based on hydrologic or hydraulic modeling of streams. The five options are:

**Two year control** (post development peak discharge rate from two year storm is held to pre development levels). It is very important to note that research studies indicate that this criteria does not protect channels from downstream erosion, and may actually exacerbate erosion since banks are exposed to a longer duration of erosive bankfull and sub-bankfull events. (MacCrae, 1993 and 1996, McCuen and Moglen, 1988). In addition, many communities have provided anecdotal evidence that two year control has failed to protect downstream channels from erosion. This evidence suggests that while the magnitude of the peak discharge is unchanged from pre to post development under two year control, the duration of erosive flows sharply increases. As a result, "effective work" on the channel (sensu Wolman et al, 1964) is shifted to smaller runoff events that range from the half year event up to the 1.5 year runoff event (MacRae, 1993). Consequently, the two year control approach is considered ineffective for stream channel protection, although it remains a useful criterion for prevention of overbank flooding.

**Two year over-control** (post development peak discharge rate to 50% or less of predevelopment level). First proposed by McCuen and Moglen (1988), this design approach recognizes the inherent

limitations of two year control. The approach emphasizes "overcontrol" of the two year storm. The most common numerical approach is to control the two year post development discharge rate to the one year predevelopment rate, using the 24 hour storm event. Subsequent analysis by Macrae (1996), however, indicates that this design criteria is still not fully capable of protecting the stream channel from erosion. His modeling suggests that "tail-end" of the post development hydrograph is subject to a considerable duration of effective work".

**24 hour detention of the one year storm event.** This criteria would result in up to 24 hours of detention for runoff generated by a rainfall depth based on annual rainfall for a region. Smaller storms events would also experience some detention, but probably much less than 24 hours. The premise of this criteria is that runoff would be stored and released in such a gradual manner that critical erosive velocities would seldom be exceeded in downstream channels. The required volume needed for 1 year extended detention is significant; it is roughly equivalent to about 90 to 95% of the required volume needed for ten year peak discharge control. Consequently, the need for two year peak discharge management would be eliminated when the 1 year ED is provided, as long as the ten year peak discharge control is achieved.

**Distributed runoff control (DRC):** This criteria has been developed by MaCrae (1993) and involves complex field assessments and modeling to determine the hydraulic stress and erosion potential of bank materials. The criteria states that channel erosion is minimized if the alteration in the transverse distribution of erosion potential about a channel parameter is maintained constant with predevelopment values, over the range of available flows, such that the channel is just able to move the dominant particle size of the bed load. This Canadian method holds promise, but has not been tested extensively in the United States and requires significantly greater data collection and modeling than any of the other methods.

**Bankfull capacity/duration criteria:** This criteria has been advanced by Tapley et al 1996, and states that the post-development, bankfull flow frequency, duration and depth must be controlled to predevelopment values at a designated control point(s) in the channel. The Rule of thumb for selecting control point(s) is to use a 10: 1 ratio of peak discharge from the one year storm for the developed site to the discharge from the stream for the same frequency storm (Tapley et al, 1996). In theory, this criteria should result in a high level of downstream protection. The practical problem is in defining how the criteria is to be interpreted; whether sub-bankfull events (that typically erode the toe of the streambank) should also be considered; and precisely where the "bankfull" should be measured. For example, the channel of many streams have been modified in the past by prior land uses and channelization, and may not represent the "true" channel. In other cases, the stormwater outfall discharge laterally to a stream, and it is therefore difficult to assign which flows the developer is actually responsible for controlling.



Conclusions

If two year control and two year overcontrol are deemed inadequate to fully protect channels from erosion, then only three options remain, each of which has some limitations. For example, both the DRC and bankfull capacity sizing criteria options lack widely accepted or universal design methodologies. In each case, local stream cross-section and/or soil measurements are needed, and considerable contention between the designer and the reviewer can be expected on how and where the analysis should be performed. Given the many operational problems currently associated with either option, and the lack of a tested design methodology at present, the two options probably deserve further study, but are not ready for wide application.

This leaves only one remaining option-- the one-year 24 hour detention criteria. It, too, has some limitations:

- Results in unacceptably small diameter orifices for sites less than ten acres in size.
- Requires a storage volume roughly equivalent to that needed for two year control.
- Has not been "tested" by continuous simulation modeling to determine if acceptable detention times can be achieved for smaller storms can be achieved (1.0 to 1.5 inches).
- Is only needed in streams that are susceptible to bank erosion.

Based on the foregoing, it appears that the best option to provide channel protection ( $C_{p_v}$ ) is 12 to 24 hour extended detention of the one-year 24 hour storm event. This  $C_{p_v}$  requirement only applies to sites greater than ten acres in size. Local governments may wish to retain the option of employing the DRC or bankfull capacity/duration criteria as an alternative, should their analytical and design requirements become more simplified and refined in the future

There are some basic exemptions to where the channel protection criteria should be applied (small drainage areas, direct discharge to tidal waters or a lake, flat terrain etc), and communities must decide how and when this criteria will be required.

# **Appendix C Model Checklists for Stormwater Management and Site Design Review**

**(Supplement to the Virginia Stormwater Management Handbook - Chapter 3 Appendix)**

**Example Checklist for  
Preliminary/Concept Stormwater Management Plan Preparation and Review**

Page 1 of 1

- G** Applicant information
- G** Name, legal address, and telephone number
- G** Common address and legal description of site
- G** Vicinity map
- G** Existing and proposed mapping and plans (recommended scale of 1" = 50'.) which illustrate at a minimum:
  - < Existing and proposed topography (minimum of 2-foot contours recommended)
  - < Perennial and intermittent streams
  - < Mapping of predominant soils from USDA soil surveys
  - < Boundaries of existing predominant vegetation and proposed limits of clearing
  - < Location and boundaries of resource protection areas such as wetlands, lakes, ponds, and other setbacks (e.g., stream buffers, drinking water well setbacks, septic setbacks)
  - < Location of existing and proposed roads, buildings, and other structures
  - < Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements
  - < Location of existing and proposed conveyance systems such as grass channels, swales, and storm drains
  - < Flow paths
  - < Location of floodplain/floodway limits and relationship of site to upstream and downstream properties and drainages
  - < Preliminary location and dimensions of proposed channel modifications, such as bridge or culvert crossings
  - < Preliminary location, size, and limits of disturbance of proposed structural stormwater management practices
- G** Hydrologic and hydraulic analysis including:
  - < Existing condition analysis for runoff rates, volumes, and velocities presented showing methodologies used and supporting calculations
  - < Proposed condition analysis for runoff rates, volumes, and velocities showing the methodologies used and supporting calculations
  - < Preliminary analysis of potential downstream impact/effects of project, where necessary
  - < Preliminary selection and rationale for structural stormwater management practices
  - < Preliminary sizing calculations for structural stormwater management practices including, contributing drainage area, storage, and outlet configuration
- G** Preliminary landscaping plans for structural stormwater management practices and any site reforestation or revegetation
- G** Preliminary erosion and sediment control plan that at a minimum meets the requirements outlined in local Erosion and Sediment Control guidelines
- G** Identification of preliminary waiver requests

**Example Checklist for  
Final Stormwater Management Plan Preparation and Review**

Page 1 of 2

- G** Applicant information
  - Name, legal address, and telephone number
- G** Common address and legal description of site
- G** Signature and stamp of registered engineer/surveyor and design/owner certification
- G** Vicinity map
- G** Existing and proposed mapping and plans (recommended scale of 1" = 50' or greater detail) which illustrate at a minimum:
  - < Existing and proposed topography (minimum of 2-foot contours recommended)
  - < Perennial and intermittent streams
  - < Mapping of predominant soils from USDA soil surveys as well as location of any site-specific borehole investigations that may have been performed.
  - < Boundaries of existing predominant vegetation and proposed limits of clearing
  - < Location and boundaries of resource protection areas such as wetlands, lakes, ponds, and other setbacks (e.g., stream buffers, drinking water well setbacks, septic setbacks)
  - < Location of existing and proposed roads, buildings, and other structures
  - < Location of existing and proposed utilities (e.g., water, sewer, gas, electric) and easements
  - < Location of existing and proposed conveyance systems such as grass channels, swales, and storm drains
  - < Flow paths
  - < Location of floodplain/floodway limits and relationship of site to upstream and downstream properties and drainages
  - < Location and dimensions of proposed channel modifications, such as bridge or culvert crossings
  - < Location, size, maintenance access, and limits of disturbance of proposed structural stormwater Management practices
- G** Representative cross-section and profile drawings and details of structural stormwater Management practices and conveyances (i.e., storm drains, open channels, swales, etc.) which include:
  - < Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.)
  - < Design water surface elevations
  - < Structural details of outlet structures, embankments, spillways, stilling basins, grade control structures, conveyance channels, etc.
  - < Logs of borehole investigations that may have been performed along with supporting geotechnical report.

**Example Checklist for  
Final Stormwater Management Plan Preparation and Review**

Page 2 of 2

- G** Hydrologic and hydraulic analysis for all structural components of stormwater system (e.g., storm drains, open channels, swales, Management practices, etc.) for applicable design storms including:
  - < Existing condition analysis for time of concentrations, runoff rates, volumes, velocities, and water surface elevations showing methodologies used and supporting calculations
  - < Proposed condition analysis for time of concentrations, runoff rates, volumes, velocities, water surface elevations, and routing showing the methodologies used and supporting calculations
  - < Final sizing calculations for structural stormwater Management practices including, contributing drainage area, storage, and outlet configuration
  - < Stage-discharge or outlet rating curves and inflow and outflow hydrographs for storage facilities (e.g., stormwater ponds and wetlands)
  - < Final analysis of potential downstream impact/effects of project, where necessary
  - < Dam breach analysis, where necessary
- G** Final landscaping plans for structural stormwater Management practices and any site reforestation or revegetation
- G** Structural calculations, where necessary
- G** Applicable construction specifications
- G** Erosion and sediment control plan that at a minimum meets the requirements of the local Erosion and Sediment Control Guidelines
  - < Sequence of construction
- G** Maintenance plan which will include:
  - < Name, address, and phone number of responsible parties for maintenance.
  - < Description of annual maintenance tasks
  - < Description of applicable easements
  - < Description of funding source
  - < Minimum vegetative cover requirements
  - < Access and safety issues
  - < Testing and disposal of sediments that will likely be necessary
- G** Evidence of acquisition of all applicable local and non-local permits
- G** Evidence of acquisition of all necessary legal agreements (e.g., easements, covenants, land trusts)
- G** Waiver requests
- G** Review agency should have inspector's checklist identifying potential features to be inspected on site visits

Example Checklist for  
**Incorporation of Better Site Design Techniques in Stormwater Management  
Plan**

Page 1 of 1

- G** Applicant information
  - < Name, legal address, and telephone number
- G** Common address and legal description of site
- G** Vicinity map
- G** Existing and proposed mapping and plans (recommended scale of 1" = 50'.) which illustrate at a minimum:
  - < Existing and proposed topography (minimum of 2-foot contours recommended)
  - < Perennial and intermittent streams
  - < Mapping of predominant soils from USDA soil surveys as well as location of any site-specific borehole investigations that may have been performed.
  - < Boundaries of existing predominant vegetation and proposed limits of clearing
  - < Location and boundaries of resource protection areas such as wetlands, lakes, ponds, and other setbacks (e.g., stream buffers, drinking water well setbacks, septic setbacks)
  - < Grading plan with location of existing and proposed roads, buildings, and other structures
  - < Location of existing and proposed utilities (e.g., water, sewer, gas, electric) and easements
  - < Location of existing and proposed conveyance systems such as grass channels, swales, and storm drains
  - < Flow paths
  - < Location of floodplain/floodway limits and relationship of site to upstream and downstream properties and drainages
  - < Location and dimensions of proposed channel modifications, such as bridge or culvert crossings
  - < Location, size, maintenance access, and limits of disturbance of proposed structural stormwater management practices
  - < Location of proposed community recreation/open space areas
  - < Landscape plan
- G** Narrative and supporting calculations describing:
  - < Zoning, acreage, types and amounts of land uses (e.g., parking spaces, density, green areas, building footprint areas, etc.)
  - < Traffic analysis estimating average daily trips for street network and parking requirements
  - < Site impervious area
  - < Reforestation and/or resource conservation protection measures
  - < Comparison of proposed development data with allowable density, land use, etc.
  - < Representative low-impact development techniques (with supporting evidence that technique is compatible with site characteristics) such as on-lot bioretention, tree clearing minimization, minimizing directly connected impervious surfaces, open section roads (also called roadside swales), etc.
  - < Development phasing or implementation sequence